

REMARKS/ARGUMENTS**I. Introduction**

This amendment is submitted in response to the Office Action dated March 23, 2006.

Claim 8 is canceled. Claims 1, 2, and 7 have been previously canceled. Accordingly, Claims 3-6 and 9-23 are now pending.

Claims 4, 10, 13, and 19 stand objected to for informalities. Claims 4, 10, 13, and 19 have been amended to correct these informalities, as suggested by the Examiner.

Claims 4, 5, 10, 11, 12, 14, 16, and 18 stand rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,424,620 B1 to Nishihara (hereinafter “the Nishihara patent”). In addition, claim 3 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the Nishihara patent in view of an art of record, “ICMP Traceback Messages” by Bellovin and Leech AT&T Labs Research (hereinafter “the Bellovin et al. publication”). Additionally, claims 6 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the Nishihara patent in view of U.S. Patent No. 6,208,653 B1 to Ogawa et al. (hereinafter “the Ogawa et al. patent”). In addition, claim 8 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the Nishihara patent in view of U.S. Patent No. 6,144,714 to Bleiweiss et al. (hereinafter “the Bleiweiss et al. patent”). Finally, claim 13 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the Nishihara patent in view of U.S. Patent No. 6,657,961 B1 to Lauffenburger et al. (hereinafter “the Lauffenburger et al. patent”).

Claims 9, 17, and 19-23 stand objected to, but would be allowable if rewritten in independent form. Applicant thanks the Examiner for this allowability. Claims 9, 17, and 19 have been amended as independent claims, including all inherent limitations. Therefore, claims 9, 17, and 19-23 (as amended) are in condition for allowance.

Applicant will now address and overcome each of the Examiner's rejections after summarizing the invention.

II. Summary of the Invention

The present invention is directed to a system for providing an anti-flooding flow-control mechanism for use in defending against flooding Denial of Service attacks. Embodiments of the invention utilize traffic baseline generation, dynamic buffer management, and early traffic regulation. Baseline statistics on the flow rates for flows of data corresponding to different classes of packets are generated. When a router senses congestion, the router may drop certain traffic based on the flow rate of that class of traffic compared to the baseline rate for that class, as well as whether the traffic is responsive to flow control signals. Further, the system may cause notification to nodes upstream of the congested node, so that the upstream nodes can restrict traffic flow based on class of traffic before it is sent along to the affected (congested) node. This may be accomplished by the congested node requesting routing information from the destination node in order to determine which nodes are upstream of the congested nodes, and then sending a traffic control signal to the upstream node.

Another aspect of some embodiments of the invention wait for congestion to occur over a pre-selected period of time before dropping traffic at or destined for the node.

III. The Nishihara patent

In contrast to the present invention, the Nishihara patent utilizes a Network Monitor to determine where congestion in an ATM network is occurring, and which nodes in the network need to cut back on traffic flow to alleviate the congestion (see col. 7, lines 49-55). In no case does the Nishihara patent teach purposely dropping traffic at the congested node, as is taught in the present invention. The Nishihara patent discloses restricting traffic at a source edge device if there is congestion at a destination edge device (see col. 9, lines 41-52), and re-routing traffic around a congested node device within the ATM network (see col. 9, lines 62-67).

Another critical difference between the Nishihara patent and the present invention is that the Nishihara patent immediately responds to a congestion situation (see col. 9, lines 37-40), whereas the present invention includes embodiments that wait to see whether a congestion situation remains for a prescribed period of time before taking action, in order to avoid dropping traffic due to a transient situation.

Still another critical difference between the Nishihara patent and the present invention is that routing of congestion information in the Nishihara patent is accomplished by sending packets from source to destination, and reply packets from destination to source, wherein a portion of the packet contains flow rates, and intermediate nodes intercept these packets and may modify the data in order to accomplish flow control (see col. 9, lines 26-67). In contrast, the present invention utilizes the node that is experiencing a congestion problem to request from the destination node the identity of the paths leading to the destination node, including upstream nodes from the congested node. Once these upstream nodes are identified, the congested node can send requests to the upstream nodes to restrict traffic toward the congested node.

IV. Claims 4, 5, 6, 10, 11, 12, 13, 14, 15, and 16 are Patentable Based on "Preselected Period of Time" Limitation

Claims 4, 5, 6, 10, 11, 12, 13, 14, 15, and 16 each contain a limitation as exemplified in Claim 4. This limitation is: **"detecting congestion in a first node along a packet flow path between a source device and a destination device, including the step of monitoring to detect when said first node is saturated with packet traffic for a preselected period of time"**. As described above, the Nishihara patent does not monitor for traffic saturation for a preselected period of time.

The Examiner argues on p. 3 of the Office Action that "the congestion would continue for a pre-selected period until the condition in formula (1) is no longer true; i.e. congestion no longer exists". While it may be true that the congestion in the Nishihara patent, once identified, is only remedied at some time in the future, there are at least three critical differences between such a period and applicant's "preselected period of time".

First, congestion may or may not continue until the Nishihara patent instructs an upstream node to control the average flowing speed. The congestion may be a temporary spike in traffic, returning on its own to an "acceptable" flow rate. In contrast, applicant's limitation requires the saturation to persist for a preselected period of time.

Second, any time lapse in the Nishihara patent between detecting congestion and remedying the problem is dependent on many factors, such as the number of intervening nodes, computation times, etc. There is no teaching or suggestion of preselecting a time during which congestion (or saturation) must persist in the Nishihara patent, as opposed to the limitation of applicant's invention of a preselected period of time.

Third, there is no teaching or suggestion in the Nishihara patent of **"monitoring to detect when said first node is saturated with packet traffic for a preselected period of time"**. Even if the Nishihara patent has an inherent lag time during which congestion may continue, there is nothing to suggest detecting saturation for that period of time. On the contrary, the Nishihara patent teaches

detecting saturation, and immediately setting out to remedy the situation, as opposed to applicant's claim 4, which requires monitoring during the preselected period of time to detect saturation over that entire period.

The Examiner refers on p. 3 to the:

"Nakamura et al. (USPN 6,463,036 B2) in col. 1, lines 57-col. 2, lines 7. Therefore, it is inherent that node 24 must detect when the node is congested with cell traffic for a pre-selected period of time)."

On the contrary, this reference teaches away from detecting saturation for a preselected period of time. Rather than wait for a preselected period of time to see whether congestion occurs during that period, this patent describes the existing technology of inserting RM cells into a user cell flow at a fixed period, transmitting the cells to a terminal point where congestion information is added to the cells, and returning the cells to the transmitting origin to lower the cell transmission speed to evade congestion (col. 1, line 59 to col. 2, line 2). The patent then goes on to describe a method of speeding up this process, to cut the time over which the congestion occurs. There is no teaching or suggestion of having a preselected period of time, or of detecting saturation over that preselected period of time.

Therefore, for at least these reasons, **claim 4 is patentable** over any combination of the Nishihara patent and the Nakamura et al. patent. Because they depend from claim 4, **claims 5 and 6 are also patentable** over these references.

Claim 10 contains the limitations:

**"operating the second node to detect when the second node is saturated with traffic for a period of time" and
"in response to detecting that said second node is saturated with traffic for said period of time, operating the second node . . .".**

The Examiner states on p. 5 of the Office Action: "node 24 must detect the occurrence of the congestion/outside blocking at the node and the node would still be congested when the BRM is generated". First, as described above, the node may or may not still be congested when the BRM is generated. In contrast, applicant's invention would "detect when the second node is saturated with traffic for a period of

time". Therefore, if the congestion is a temporary spike, the Nishihara patent would still send a BRM to reduce traffic flow, whereas applicant's invention would not restrict traffic flow, because the saturation would be found **not to exist for a period of time**.

For this reason, and for the reasons argued above with regard to claim 4, **claim 10 is patentable** over the cited references. Because they depend from claim 10, **claims 11, 12, 13, 14, 15, and 16 are also patentable** over the cited references.

V. Claims 3, 5, 6, 11, 12, 13, 14, 15, and 16 are patentable Based on "Requesting Path Information" Limitation

Claims 3, 5, 6, 11, 12, 13, 14, 15, and 16 each contain a limitation as exemplified in Claim 3. This limitation is: **"transmitting a signal to said destination device requesting path information"**. The Examiner states on p. 9 of the Office Action: "However, Nishihara fails to teach identifying a node in said path preceding said first node which includes transmitting a signal to the destination device requesting path information." Applicant agrees with this deficiency of the Nishihara patent.

The Examiner goes on to state that the Bellovin publication teaches an ICMP Traceback message which it would have been obvious to incorporate into the Nishihara patent, and the result would be applicant's "requesting path information" limitation.

First, there is no reason to combine the Bellovin publication with the Nishihara patent, as the former is directed to Denial of Service attacks, and the latter is directed to a congestion control system.

Second, the Bellovin publication does not teach "transmitting a signal to said destination device requesting path information". To the contrary, the publication teaches sending multiple ICMP Traceback messages randomly from multiple routers in a network (section 3, paragraph 2), with the hope that "With enough Traceback messages from enough routers along the path, the traffic source and path can be determined." There is no teaching or suggestion of a destination device having the

path information, nor of another node transmitting a signal to the destination device requesting path information. Again, the purpose of such a technique is to allow network administrators to piece together the identity of the origination device causing flooding of a network. As is stated in section 7, "It is limited to those [denial of service attacks] where a significant amount of traffic is coming from a relatively small number of sources."

In conclusion, even if the Bellovin publication teachings were incorporated into the Nishihara patent, the resultant system would not teach or suggest "transmitting a signal to said destination device requesting path information". Therefore, **claim 3 is patentable** over the cited references.

Claim 5 contains the limitation "wherein said traffic regulation signal further includes packet flow path information". The Examiner states on p. 4 of the Office Action that the BRM packet includes flow path information. Applicant respectfully disagrees. As shown in Fig. 5 and described at col. 10, lines 19-36, the BRM packet contains only the addresses of the source and destination nodes, along with the address of any transfer node which is congested. This teaches away from "flow path" information of applicant's invention. The Nishihara patent operates by controlling source and destination edge devices to identify and control congestion within the network, and therefore has no need to (and does not) identify path information. On the contrary, applicant's invention utilizes path information to identify nodes upstream of congested nodes, in order to control congestion at these upstream nodes.

Based at least on the above limitation, **claim 5 is patentable** over the Nishihara patent. Therefore, dependent **claim 6 is patentable** over the Nishihara patent.

Claim 11 contains the limitation "initiating a path determination operation to determine at least a portion of a path of a flow causing congestion at said second node". The Examiner claims on p. 5 of the Office Action that because the Nishihara patent includes the addresses of the source and destination nodes, it inherently initiates a path determination operation, in order for the BRM packet to "be returned correctly to the source node 23". However, at col. 9, lines 30-34 it states:

"The RM packet and the BRM packet are transferred being relayed by the respective node devices 25-1 . . . 25-N according to the destination information, in the same way as a user packet". This again teaches away from determining **path information**. The packets are given a destination address, and pass node-to-node to that destination, using the tables in each node along the way to identify the next intermediate node. There is certainly no "path determination operation to determine at least a portion of a path of a flow causing congestion". The only path determined (again, on a node-by-node basis) is the path that the RM or BRM packet takes to its destination address.

For at least these reasons, **claim 11 is patentable over the Nishihara patent**. Therefore, dependent **claims 12, 13, 14, 15, and 16 are also patentable over the cited references**.

Claim 18 contains the limitation "**traffic flow determination means for determining the path of at least one packet flow causing congestion at said first network node**". The Examiner state on p. 6 of the Office Action:

the traffic flow path determination means reads on the BRM packet inserting unit 78 in Fig. 4 which must determine the path of the flow between the source node 23 and the destination node 24 in order to correctly return the BRM packet to the source node 23 according to the destination information, i.e. via the respective node devices 25-N, . . . 25-1, col. 12, lines 26-30, see also col. 9, lines 26-33.

As described above, the Nishihara patent teaches passing BRM packets node-to-node to the destination address, using tables in each node along the way to identify the next intermediate node (col. 9, lines 30-34). Again, this teaches away from applicant's "**traffic flow determination means for determining the path of at least one packet flow causing congestion at said first network node**". The Nishihara patent routes packets according to their destination address, and applicant's invention determines the path of the packet flow **which caused the congestion**.

For at least these reasons, **claim 18 is patentable over the Nishihara patent**.

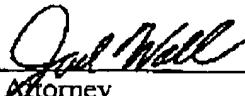
VI. Conclusion

Claims 3-6 and 9-23, as amended, are not rendered unpatentable by any combination of the cited references, and therefore it is respectfully submitted that they are in condition for allowance. Applicant respectfully submits that the pending claims are in condition for allowance. Accordingly, Applicant requests that the Examiner pass this application to issue.

If there are any outstanding issues which need to be resolved to place the application in condition for allowance the Examiner is invited to contact Applicant's undersigned representative by phone to discuss and hopefully resolve said issues. To the extent necessary, a petition for extension of time under 37 C.F.R. 1.136 is hereby made, the fee for which should be charged to Patent Office deposit account number 07-2347.

Respectfully submitted,

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Signature:


(Christian R. Andersen)